ATTACHMENT 3: RES RETAIL RATE IMPACT

# The Empire District Electric Company 2017 RES Filing

The Empire District Electric Company ("Empire") requested that ABB perform modeling for their Electric Utility Renewable Energy Standard (RES) Requirements. The modeling included calculating the retail rate impact per section 5 of Missouri 4 CSR 240-20.100 (the "Rule").

## Assumptions:

Rule 5 (B) 1 states that the non-renewable gneration and purchase power portfolio shall be determined by adding, to the utility's existing generation and purchased power resource portfolio excluding all renewable resources, additional non-renewable resources sufficient to meet the utility's needs on a least-cost basis for the next ten (10) years. To achieve this portfolio, ABB removed the following renewables from the 2016 IRP resources; 1) Elk River and Meridian Way Wind – 36 MWs of Accredited Capacity, Ozark Beach Hydro – 16 MWs of Accredited Capacity, 2029 Future Wind – 15 MWs of Accredited Capacity and 2031 Future wind – 22.5 MWs of Accredited Capacity . In addition, the impact of the residential and commercial solar additions that were removed from the load forecast by Itron were added back. To account for the loss of capacity, the 2029 combined cycle was brought on in 2026 and an additional 100 MW combined cycle was added in 2033 in order to maintain a minimum capacity margin of 12%.

Rule 5 (B) 2 states that the RES-compliant portfolio shall be determined by adding to the utility's existing generation and purchased power resource portfolio an amount of least cost renewable resources sufficient to achieve the portfolio requirements set forth in section (2) of this rule and an amount of least-cost non-renewable resources, the combination of which is sufficient to meet the utility's needs for the next ten (10) years. ABB is using the preferred plan (Plan 5) from Empire's latest IRP filing. Plan 5 included renewable resources that meet the RES requirements set forth in section (2). As required by rule 5 (C), rebates made during each calendar year were also included in the cost of generation from renewable energy resouces. 2015-2017 budgeted solar capacity was updated with actual solar rebated operational capacity. The difference between actual and budget was added as a solar resource in order to offset the impact on the load forecast. 2015-2017 budgeted solar rebates paid were also updated for actuals.
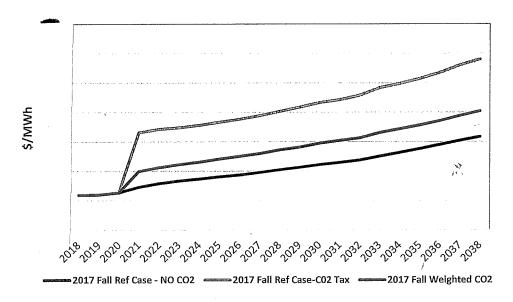
Rule 5 (B) 4 states that the assumptions regarding projected renewable energy resource additions will utilize the most recent electric utility resouce planning analysis. Weighting of the greenhouse gas emissions and market prices were developed using ABB's 2017 Fall Midwest Power Reference Case. A 70% weighting was given to the no-carbon tax scenario and 30% to the carbon tax scenario.

Table 1 includes the expected value of costs associated with greenhouse gas emissions used in this analysis. Weighted market prices were developed in ABB's 2017 Fall Reference Case database with modifications that included a weighted carbon tax. Figure 1 includes market prices for the SPP-KSMO market area with the impact of a carbon tax begining in 2021.

*Table 1 Expected Value Carbon Tax*

| Year | 70% No Carbon | 30% Fall 2017 Ref Case | Expected Value |
|------|---------------|------------------------|----------------|
| 2017 | - | | |
| 2018 | - | | |
| 2019 | - | | |
| 2020 | - | | |
| 2021 | - | | |
| 2022 | - | | |
| 2023 | - | | |
| 2024 | - | | |
| 2025 | - | | |
| 2026 | - | | |
| 2027 | - | | |
| 2028 | - | | |
| 2029 | - | | |
| 2030 | - | | |
| 2031 | | | |
| 2032 | | | |
| 2033 | | | |
| 2034 | | | |
| 2035 | | | |
| 2036 | | | |
| 2037 | | | |

*Figure 1 SPP-KSMO 7 x 24 Weighted Market Prices (Nominal $/MWh)*



2017 Fall Ref Case - NO CO2 ─── 2017 Fall Ref Case-C02 Tax ─── 2017 Fall Weighted CO2

# Results:

The following table shows the 1% calculation for the 10 year average over the succeeding 10-year period required by Rule 5 (B).

*Table 2  Annual Revenue Requirements*

|  | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | Total |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Actual Spend - 2018-2027 | | | | | | | | | | | |
| Budget - 2018-2027 | | | | | | | | | | | |
| Revenue Requirements 2018-2027 | | | | | | | | | | | |
| Budget % of Revenue Requirements | | | | | | | | | | | |
| Actual % of Revenue Requirements | 2.6% | 2.5% | 2.2% | 0.1% | -0.2% | -0.4% | -0.8% | -1.2% | -1.5% | -3.9% | -0.1% |

The following tables summarize the Retail Rate Impact calculation required by Rule 5 (G).

*Table 3 2018-2027 RRI Calculation Period*

| 2018-2027 RRI Calculation Period | 2018 | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 |
|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | |
| Actual Costs | | | | | | | | | | |
| Annual Over/(Under) | | | | | | | | | | |
| Plus Prior Carryover | 8.455 | | | | | | | | | |
| Cumulative carryover - over/(under) | 17.382 | 25.737 | 32.823 | 27.568 | 19.981 | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 |

*Table 4 2019-2028 RRI Calculation Period*

| 2019-2028 RRI Calculation Period | 2019 | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | |
| Annual Over/(Under) | 8.356 | 7.085 | -5.254 | -7.588 | -8.747 | -11.494 | -14.771 | -16.727 | -34.506 | -33.097 | |
| Plus Prior Carryover | 17.382 | | | | | | | | | | |
| Cumulative carryover - over/(under) | 25.737 | 32.823 | 27.568 | 19.981 | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | |

*Table 5 2020-2029 RRI Calculation Period*

| 2020-2029 RRI Calculation Period | 2020 | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | |
| Annual Over/(Under) | 7.085 | -5.254 | -7.588 | -8.747 | -11.494 | -14.771 | -16.727 | -34.506 | -33.097 | -46.231 | |
| Plus Prior Carryover | 25.737 | | | | | | | | | | |
| Cumulative carryover - over/(under) | 32.823 | 27.568 | 19.981 | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | |

## Table 6 2021-2030 RRI Calculation Period

| 2021-2030 RRI Calculation Period | 2021 | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 10-Year "Budget" | Cumulative "Budget" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | ̶5̶8̶ ̶2̶1̶0̶ | ̶6̶7̶9̶ ̶2̶7̶5̶ | 607.706 | 707.576 | 717.009 | 725.249 | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| Annual Over/(Under) | -5.254 | -7.588 | -8.747 | -11.494 | -14.771 | -16.727 | -34.506 | -33.097 | -46.231 | 3.948 | | |
| Plus Prior Carryover | 32.823 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | 27.568 | 19.981 | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | | |

## Table 7 2022-2031 RRI Calculation Period

| 2022-2031 RRI Calculation Period | 2022 | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 10-Year "Budget" | Cumulative "Budget" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | ̶7̶1̶7̶ ̶0̶0̶9̶ | ̶7̶2̶5̶ ̶2̶4̶9̶ | 728.838 | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| Annual Over/(Under) | -7.588 | -8.747 | -11.494 | -14.771 | -16.727 | -34.506 | -33.097 | -46.231 | 3.948 | -18.097 | | |
| Plus Prior Carryover | 27.568 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | 19.981 | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | | |

## Table 8 2023-2032 RRI Calculation Period

| 2023-2032 RRI Calculation Period | 2023 | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| Annual Over/(Under) | -8.747 | -11.494 | -14.771 | -16.727 | -34.506 | -33.097 | -46.231 | 3.948 | -18.097 | 29.216 | | |
| Plus Prior Carryover | 19.981 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | 11.233 | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | -130.526 | | |

## Table 9 2024-2033 RRI Calculation Period

| 2024-2033 RRI Calculation Period | 2024 | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| Annual Over/(Under) | | | | | | | | | | | | |
| Plus Prior Carryover | 11.233 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | -0.261 | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | -130.526 | -107.525 | | |

## Table 10 2025-2034 RRI Calculation Period

| 2025-2034 RRI Calculation Period | 2025 | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 10-Year "Budget" | Cumulative "Budget" |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | ̶7̶3̶9̶ ̶0̶0̶4̶ | 769.474 | 811.113 | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| Annual Over/(Under) | -14.771 | -16.727 | -34.506 | -33.097 | -46.231 | 3.948 | -18.097 | 29.216 | 23.001 | -4.170 | | |
| Plus Prior Carryover | -0.261 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | -15.032 | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | -130.526 | -107.525 | -111.695 | | |

## Table 11 2026-2035 RRI Calculation Period

| 2026-2035 RRI Calculation Period | 2026 | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Annual Over/(Under) | -16.727 | -34.506 | -33.097 | -46.251 | 3.948 | -18.097 | 29.216 | 23.001 | -4.170 | -11.302 | | |
| Plus Prior Carryover | -15.032 | | | | | | | | | | | |
| Cumulative carryover - over/(under) | -31.759 | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | -130.526 | -107.525 | -111.695 | -122.997 | | |

## Table 12 2027-2036 RRI Calculation Period

| 2027-2036 RRI Calculation Period | 2027 | 2028 | 2029 | 2030 | 2031 | 2032 | 2033 | 2034 | 2035 | 2036 | | Cumulative |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Baseline Revenue Req (MM$) | | | | | | | | | | | | |
| Annual 1% (MM$) | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Actual Costs | | | | | | | | | | | | |
| | | | | | | | | | | | | |
| Annual Over/(Under) | | | | | | | | | | | | |
| Plus Prior Carryover | | | | | | | | | | | | |
| Cumulative carryover - over/(under) | -66.265 | -99.361 | -145.593 | -141.645 | -159.742 | -130.526 | -107.525 | -111.695 | -122.997 | -140.017 | | |